Ch-24 (27)

LAB - ANALYSIS OF CIRCUITS

filename: circuits

NAME: _____

PURPOSE: This is a simulation done on a computer. The exercise is for you to write formulas in simulated voltmeters and ammeters so that no matter what the instructor types into the blocks for battery voltage and resistances, the circuit will immediately adjust and give the correct voltages and currents. There are further analysis questions *to* be answered once you get the circuit working correctly.

SETUP: Open up the program Excel. From that program, open the file called circuits.xls. You will see a spreadsheet with three sheets. Each sheet contains a separate: circuit to analyze. If the full circuit does not fit your screen, adjust the percentage of view down to 60% and it should fit.

PRODECURE for PART I: In the first circuit, called Series Circuit, there are already values for the battery voltage and the values of the resistors. You must type in formulas in the boxes labeled as A1, A2, A_{total}, and R_{total}. The formulas must be interactive, that is, if any changes are made *to* the battery voltage, V_{total}, or value of R1 and/or R2, the entire circuit changes, and your formulas cause the correct values to appear in the boxes. *Type <u>only</u> in the labeled boxes.* When you have the circuit working, proceed to the analysis questions.

ANALYSIS:

A1. Type in double the value of the battery voltage into the V_{total} box. What happens to the value of the current at both points where current is measured?

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A2. Type in increasing values of resistance for R1. What happens to the current at both points where current is measured?

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A3. As you typed in increasing values of resistance at RI, what happened to the value of the voltage over R1? What happens to the value of voltage over R2?

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A4. As you typed in increasing values of resistance at R1, what happens to the sum of the voltages, and in particular compare the sum of the voltages over R1 and R2 to the V_{total}?

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PRODECURE for PART II: In the second circuit, called Parallel Circuit, there are already values for the battery voltage, V_{total} , and the values of the resistors, R1 and R2. You must type in formulas in the boxes labeled as V1, V2, A1, A2, A_{total} , and R_{total}. The formulas must be interactive, that is, if any changes are made to the battery voltage, V_{total}, or value of R1 and/or R2, the entire circuit changes, and your formulas cause the correct values to appear in the boxes. *Type <u>only</u> in the labeled boxes.* When you have the circuit working, proceed to the analysis questions.

A5. Change the value of R1 to higher and higher values, all the way to 1000 ohms, perhaps. What happens to the value of the total resistance, R_{total}? How does the value of the total resistance compare to the values of R1 and R1. As you get the value of R1 to values much higher than R2, what happens to the value of the total resistance?

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A6. As you change the values of R1 to higher values, what happens to the voltage across the resistances R1 and R1?

A7. As you change the values of R1 to higher values, what happens to the current in R1 and what happens to the current in R1?

A8. As you change the values of R1 to higher values, what happens to the sum of the currents in R1 and R1 compared to the total current, A_{total}?

PRODECURE for PART III: In the second circuit, called **Combination Circuit**, there are already values for the battery voltage, V_{total} , and the values of the resistors, R1, R2 and R3. You must type in formulas in the boxes labeled as V1, V2, A1, A2, A_{total} , and R_{total}. The formulas must be interactive, that is, if any changes are made to the battery voltage, V_{total}, or value of R1 and/or R2, the entire circuit changes, and your formulas cause the correct values to appear in the boxes. *Type <u>only</u> in the labeled boxes.* When you have the circuit working, proceed to the analysis questions.

A9. Change the value of R1 to higher and higher values, all the way to 1000 ohms, perhaps. What happens to the value of the total resistance, R_{total}? How does the value of the total resistance compare to the values or R1 and R2. As you get the value of R1 to values much higher than R2, what happens to the value of the total resistance compared to the sum of R2 and R3 ?

A10. *As* you change the values of R1 to higher values, what happens to the voltage across the resistances R3 and R2?

A11. As you change the values of R1 to higher values, what happens to the current in R2 and what happens to the current in R3?

A12. As you change the values of R1 to higher values, what happens to the sum of the currents in R1 and R2 compared to the total current, A_{total}?

Write a paragraph about the concepts you have learned in this experiment.